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**Orbital Picture of Yu-Shiba-Rusinov Multiplets<sup>1</sup>** BENJAMIN W. HEINRICH, MICHAEL RUBY, KATHARINA J. FRANKE, Fachbereich Physik, Freie Universität Berlin, YANG PENG, FELIX VON OPPEN, Dahlem Center for Complex Quantum Systems and Fachbereich Physik, Freie Universität Berlin — Magnetic impurities on an *s*-wave superconductor induce Yu-Shiba-Rusinov (YSR) bound states within the excitation gap of the superconductor. Here, we investigate single manganese (Mn) atoms adsorbed on different surface orientations of superconducting lead (Pb) and the nature of their YSR states. Depending on the adsorption site and surface, we detect a distinct number and characteristic patterns of YSR states around the Mn atoms. We show that the YSR states inherit their properties from the Mn *d* levels, which are split by the surrounding crystal field [1]. The periodicity of the long-range YSR oscillations allows us to identify a dominant coupling of the *d* states to the outer Fermi sheet of the two-band superconductor Pb. The long-range and directional nature of the states are promising for the design of coupled adatom structures, which could bear topological phases.  
[1] M. Ruby *et al.*, Phys. Rev. Lett. **117**, 186801 (2016).

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